

## CLAIMS

- 1 1. A method for fast reboot of a computer having an attached disk array and an in-  
2 ternal random access memory (RAM) comprising the steps of:  
3 retaining a copy of in-memory data, from which a operating system kernel is re-  
4 loaded, on a reserved storage location of the RAM;  
5 performing predetermined reboot operations with a boot mechanism; and  
6 reloading the operating system at a location in the RAM based upon the copy of  
7 the operating system retained at the reserved storage location after the step of performing  
8 the predetermined reboot operations.
- 1 2. The method as set forth in claim 1 wherein the boot mechanism is adapted to per-  
2 form predetermined full reboot steps based upon a full reboot instruction from the oper-  
3 ating system, and wherein the predetermined reboot operations omit the predetermined  
4 full reboot steps when the operating system is reloaded from the reserved storage location  
5 based upon a warm reboot instruction so as to perform a less-than-full reboot.
- 1 3. The method as set forth in claim 2 wherein the predetermined full reboot steps  
2 include loading into the memory a copy of on-disk data from which the operating system  
3 kernel is reloaded, and the predetermined full reboot steps further include at least one of  
4 (a) fully clearing of the RAM, including the reserved storage location, and (b) fully test-  
5 ing the RAM.
- 1 4. The method as set forth in claim 3 wherein the predetermined full reboot steps  
2 further include testing at least one of an LCD display chip and a Serial Input/Output  
3 (SIO) chip.
- 1 5. The method as set forth in claim 2 wherein the copy of in-memory data comprises  
2 a compressed image of the operating system kernel adapted to be uncompressed and ex-  
3 tracted to form the operating system at the location in the RAM.

1 6. The method as set forth in claim 5 wherein the step of reloading includes loading  
2 the compressed image of the operating system kernel from the reserved storage location  
3 to a space within the RAM and thereafter uncompressing and extracting the operating  
4 system kernel into the RAM from the compressed image of the operating system loaded  
5 into the RAM.

1 7. The method as set forth in claim 6 further comprising, after the step of uncom-  
2 pressing and extracting, freeing-for-overwrite the space within the RAM into which the  
3 compressed image of the operating system kernel is loaded.

1 8. The method as set forth in claim 6 wherein one of the predetermined full reboot  
2 steps comprises copying the compressed image of the operating system into the reserved  
3 storage space from the compressed image of the operating system in the RAM.

1 9. The method as set forth in claim 2 wherein one of the predetermined reboot steps  
2 comprises loading the in-memory copy of the data at the reserved storage location based  
3 upon a disk-stored copy of the data on the array of disks.

1 10. The method as set forth in claim 2 further comprising providing a warm reboot  
2 instruction in response to a condition that enables the less-than-full reboot of the com-  
3 puter.

1 11. The method as set forth in claim 10 wherein the condition includes at least one of  
2 a user-generated warm reboot command and a predetermined software panic condition  
3 that can be repaired by the less-than-full reboot of the computer.

1 12. The method as set forth in claim 10 wherein the step of providing the warm re-  
2 boot instruction includes setting a flag in the boot mechanism from a full reboot state to a  
3 warm reboot state.

1 13. The method as set forth in claim 10 further comprising reverting to the full reboot  
2 if the copy of the data is corrupted.

1 14. A system for performing a fast reboot of a computer having an array of attached  
2 disks and an internal memory comprising:

3 a boot mechanism that carries out full reboot operations on the file server, the  
4 boot mechanism including a flag adapted to indicate performance by the boot mechanism  
5 of either (a) the full reboot operations or (b) warm reboot operations wherein at least one  
6 of the full reboot operations is skipped.

1 15. The system as set forth in claim 14 wherein the full reboot operations that are  
2 skipped include a full test of the memory, a zeroing of the memory, a shutdown of a  
3 processor of the file server and a loading of data from the array of disks that generates the  
4 operating system kernel at a predetermined kernel location in the memory.

1 16. The system as set forth in claim 15 wherein the memory includes a reserved stor-  
2 age space that stores a copy of data from which the operating system is loaded into the  
3 predetermined location in the memory during the warm reboot operations, the boot  
4 mechanism being adapted to retain uncleared the reserved storage space during the warm  
5 reboot operations, and being adapted to clear the reserved storage space during the full  
6 reboot operations.

1 17. The system as set forth in claim 16 wherein the copy of the data stored in the re-  
2 served storage space is a compressed image of the operating system kernel and the boot  
3 mechanism is adapted to load the compressed image of the operating system kernel from  
4 the reserved storage space into a space in the memory outside the reserved storage space,  
5 and further comprising a boot loader that subsequently uncompresses and extracts the  
6 compressed image of the operating system kernel at the space in the memory outside the  
7 reserved storage space to generate the operating system kernel at the predetermined ker-  
8 nel location in the memory.

22. A method for carrying out a warm reboot on a computer having a random access  
memory (RAM) and an array of attached disks that skips predetermined full reboot steps  
comprising the steps of:

directing a boot mechanism that carries out the full reboot steps to undergo a warm reboot;

retaining an uncleared reserved storage space in the RAM so as to store in-memory data from which the operating system kernel is generated; and

after predetermined warm reboot steps are performed, generating the operating system kernel from the in-memory data in a portion of the RAM outside the reserved storage space.

23. The method as set forth in claim 22 wherein the step of generating the operating system kernel includes uncompressing a compressed image of the operating system kernel.

24. The method as set forth in claim 23 wherein the step generating further includes copying the in-memory data to form the compressed image of the operating system kernel at a location within the portion of the RAM outside the reserved storage location.

25. The method as set forth in claim 23 wherein the step of generating includes performing an error check on the data and, if the in-memory data is corrupted, reverting to the full reboot steps.

26. The method as set forth in claim 23 wherein the full reboot steps include (a) clearing the reserved storage space, (b) loading, from the disk array, on-disk data from which the operating system kernel is generated and (c) copying the on-disk data to the reserved storage space to thereby store the in-memory data.

27. The method as set forth in claim 26 wherein the full reboot steps further comprise at least one of (a) fully clearing the memory, and (b) performing a full test of the memory.

28. A method for fast reboot of a computer having the random access memory comprising the steps of:

3 performing predetermined reboot steps with a boot mechanism; and  
4 reloading an operating system kernel extracted from a stored operating system  
5 kernel image, the operating system kernel image being stored in a reserved location of the  
6 random access memory prior to the step of performing the predetermined reboot steps,  
7 the reserved location remaining uncleared after the step of performing the predetermined  
8 reboot steps.

1 29. A method for rebooting a computer comprising the steps of:  
2 in response to a predetermined reboot command, selectively reloading an operat-  
3 ing system kernel to a memory of the computer from either a first compressed kernel im-  
4 age of the operating system or a second compressed kernel image of the operating sys-  
5 tem, each of the first compressed kernel image and the second compressed kernel image  
6 being located on different non-removable storage media, wherein an access speed for the  
7 first compressed kernel image is quicker than an access speed for the second compressed  
8 kernel image.

1 30. The method as set forth in claim 29 further comprising storing the first com-  
2 pressed kernel image is on a reserved space of the memory that remains uncleared during  
3 a warm reboot process having predetermined warm reboot steps and storing the second  
4 compressed kernel on a disk operatively interconnected to the computer.

1 31. The method as set forth in claim 30 wherein the step of storing the first com-  
2 pressed kernel image includes loading a copy of the second compressed kernel image  
3 onto the reserved space during a full reboot process that includes both full reboot steps  
4 and the predetermined warm reboot steps.

1 32. The method as set forth in claim 31 wherein the full reboot steps include clearing  
2 the memory, including the reserved storage space and testing each of an LCD display  
3 chip and a serial input/output (SIO) chip.

3 a warm reboot instruction, responsive to a predetermined reboot condition, that  
4 sets an indicator in a boot mechanism of the computer to perform a warm reboot process  
5 that includes predetermined boot steps that are fewer than the boot steps performed by the  
6 boot mechanism in response to a full reboot instruction.

35. The operating system as set forth in claim 34 further comprising a compressed kernel image located at a reserved storage space in the memory that is remote from the area controlled by the operating system and that remains uncleared during the warm reboot process, the compressed kernel image located at the reserved storage space being adapted to be accessed to reload the compressed kernel image into the memory during a warm reboot process.

37. The operating system as set forth in claim 33 wherein the indicator includes a plu-  
rality of warm reboot levels that enable each of the boot steps of the full reboot process to  
be selectively performed or skipped.